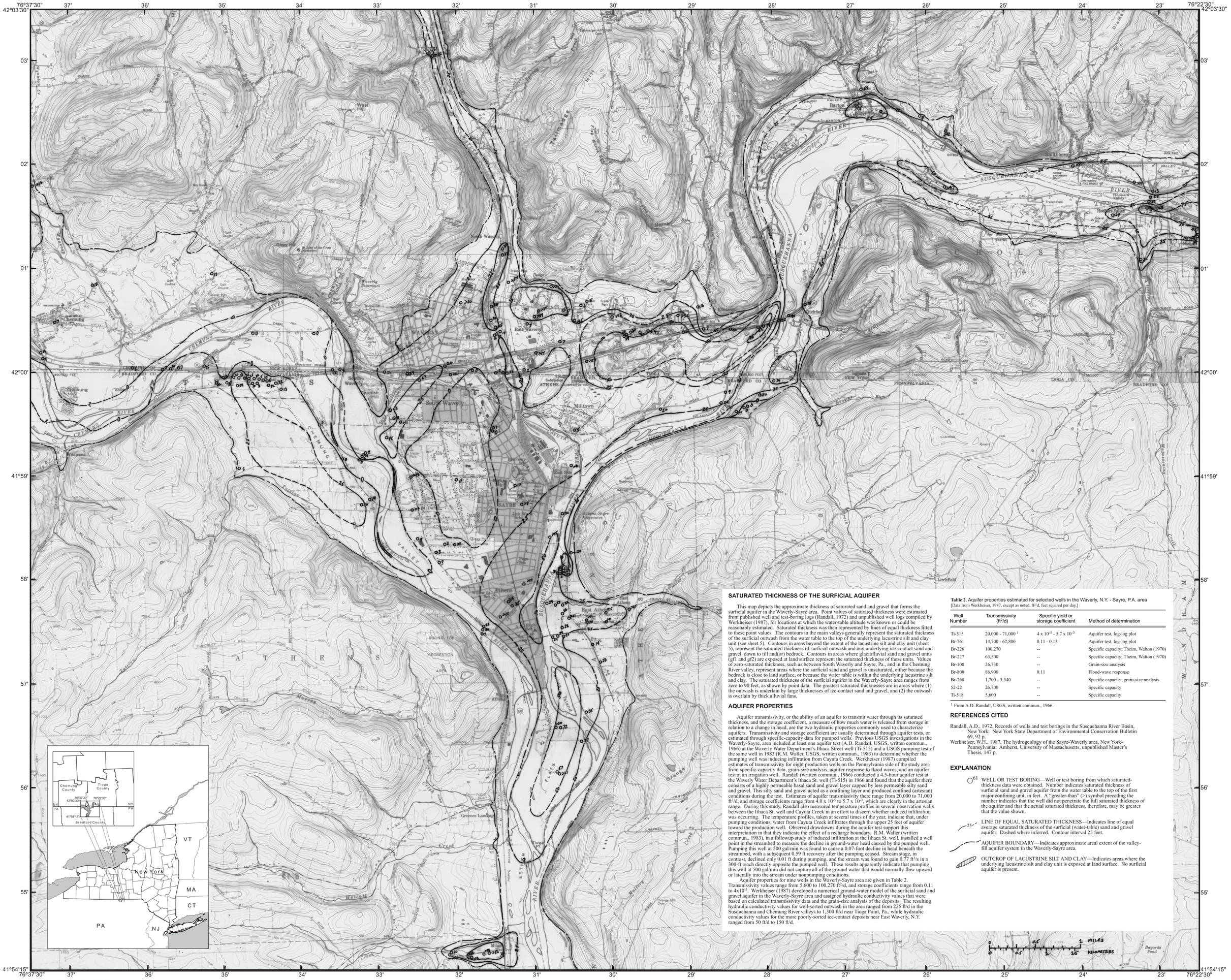
U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

Prepared in cooperation with
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

OPEN-FILE REPORT 02-284
SATURATED THICKNESS OF THE SURFICIAL AQUIFER – SHEET 4 of 6
Reynolds, R.J., 2003, Hydrogeology of the Waverly-Sayre area in Tioga and Chemung Counties, New York and Bradford County, Pennsylvania: U.S. Geological Survey Open-File Report 02-284, 6 sheets, 1:24,000 scale.



SATURATED THICKNESS OF THE SURFICIAL AQUIFER

This map depicts the approximate thickness of saturated sand and gravel that forms the surficial aquifer in the Waverly-Sayre area. Point values of saturated thickness were estimated from published well and test-boring logs (Randall, 1972) and unpublished well logs compiled by Werkheiser (1987), for locations at which the water-table altitude was known or could be reasonably estimated. Saturated thickness was then represented by lines of equal thickness fitted to these point values. The contours in the main valleys generally represent the saturated thickness of the surficial outwash from the water table to the top of the underlying lacustrine silt and clay unit (see sheet 5). Contours in areas beyond the extent of the lacustrine silt and clay unit (sheet 5), represent the saturated thickness of surficial outwash and any underlying ice-contact sand and gravel, down to till and(or) bedrock. Contours in areas where glaciofluvial sand and gravel units (gf1 and gf2) are exposed at land surface represent the saturated thickness of these units. Values of zero saturated thickness, such as between South Waverly and Sayre, Pa., and in the Chemung River valley, represent areas where the surficial sand and gravel is unsaturated, either because the bedrock is close to land surface, or because the water table is within the underlying lacustrine silt and clay. The saturated thickness of the surficial aquifer in the Waverly-Sayre area ranges from zero to 90 feet, as shown by point data. The greatest saturated thicknesses are in areas where (1) the outwash is underlain by large thicknesses of ice-contact sand and gravel, and (2) the outwash is overlain by thick alluvial fans.

AQUIFER PROPERTIES

Aquifer transmissivity, or the ability of an aquifer to transmit water through its saturated thickness, and the storage coefficient, a measure of how much water is released from storage in relation to a change in head, are the two hydraulic properties commonly used to characterize aquifers. Transmissivity and storage coefficient are usually determined through aquifer tests, or estimated through specific-capacity data for pumped wells. Previous USGS investigations in the Waverly-Sayre, area included at least one aquifer test (A.D. Randall, USGS, written commun., 1966) at the Waverly Water Department's Ithaca Street well (Ti-515) and a USGS pumping test of the same well in 1983 (R.M. Waller, USGS, written commun., 1983) to determine whether the pumping well was inducing infiltration from Cayuta Creek. Werkheiser (1987) compiled estimates of transmissivity for eight production wells on the Pennsylvania side of the study area from specific-capacity data, grain-size analysis, aquifer response to flood waves, and an aquifer test at an irrigation well. Randall (written commun., 1966) conducted a 4.5-hour aquifer test at the Waverly Water Department's Ithaca St. well (Ti-515) in 1966 and found that the aquifer there consists of a highly permeable basal sand and gravel layer capped by less permeable silty sand and gravel. This silty sand and gravel acted as a confining layer and produced confined (artesian) conditions during the test. Estimates of aquifer transmissivity there range from 20,000 to 71,000 ft^2/d, and storage coefficients range from 4.0×10^{-5} to 5.7×10^{-3}, which are clearly in the artesian range. During this study, Randall also measured temperature profiles in several observation wells between the Ithaca St. well and Cayuta Creek in an effort to discern whether induced infiltration was occurring. The temperature profiles, taken at several times of the year, indicate that, under pumping conditions, water from Cayuta Creek infiltrates through the upper 25 feet of aquifer toward the production well. Observed drawdowns during the aquifer test support this interpretation in that they indicate the effect of a recharge boundary. R.M. Waller (written commun., 1983), in a followup study of induced infiltration at the Ithaca St. well, installed a well point in the streambed to measure the decline in ground-water head caused by the pumped well. Pumping this well at 500 gal/min was found to cause a 0.07-foot decline in head beneath the streambed, with a subsequent 0.59 ft recovery after the pumping ceased. Stream stage, in contrast, declined only 0.01 ft during pumping, and the stream was found to gain 0.77 ft^3/s in a 300-ft reach directly opposite the pumped well. These results apparently indicate that pumping this well at 500 gal/min did not capture all of the ground water that would normally flow upward or laterally into the stream under nonpumping conditions.

Aquifer properties for nine wells in the Waverly-Sayre area are given in Table 2. Transmissivity values range from 5,600 to 100,270 ft^2/d, and storage coefficients range from 0.11 to $4x10^{-5}$. Werkheiser (1987) developed a numerical ground-water model of the surficial sand and gravel aquifer in the Waverly-Sayre area and assigned hydraulic conductivity values that were based on calculated transmissivity data and the grain-size analysis of the deposits. The resulting hydraulic conductivity values for well-sorted outwash in the area ranged from 225 ft/d in the Susquehanna and Chemung River valleys to 1,300 ft/d near Tioga Point, Pa., while hydraulic conductivity values for the more poorly-sorted ice-contact deposits near East Waverly, N.Y. ranged from 50 ft/d to 150 ft/d.

REFERENCES CITED

Randall, A.D., 1972, Records of wells and test borings in the Susquehanna River Basin, New York: New York State Department of Environmental Conservation Bulletin 69, 92 p.

Werkheiser, W.H., 1987, The hydrogeology of the Sayre-Waverly area, New York-Pennsylvania: Amherst, University of Massachusetts, unpublished Master's Thesis, 147 p.

Base from U.S. Geological Survey
1:24,000 Series: Waverly, NY-PA (1978);
Sayre, PA-NY (1969), Litchfield, PA-NY (1978)
Barton, NY-PA (1976)

HYDROGEOLOGY OF THE WAVERLY–SAYRE AREA IN TIOGA AND CHEMUNG COUNTIES, NEW YORK AND BRADFORD COUNTY, PENNSYLVANIA

By
Richard J. Reynolds
2003

Sheet 4 - Saturated Thickness of the Surficial Aquifer

Hydrogeology by R. J. Reynolds, 2001

For additional information write to:
District Chief, U.S. Geological Survey, 425 Jordan Road, Troy, NY 12180

Copies of this report are available on-line at http://ny.usgs.gov or can be purchased from:
U.S. Geological Survey, Branch of Information Services, Box 25286, Denver, CO 80225-0286